We claim:

1. A method for improving signal-to-noise ratio of a signal containing noise, the method comprising the steps, performed by a processor, of:

receiving an analog signal comprising a desired signal and noise;

obtaining a set of N samples representing digital representations of in-phase (I) and quadrature (Q) components of the analog signal;

combining the set of N sample with specially selected weighting coefficients;

combining the weighted sample pairs with a phase-rotated Nth sample; and

outputting a modified signal, wherein the modified signal is a function of the weighted samples and the phase-rotated Nth sample.

2. The method of claim 1, wherein the step of obtaining in-phase (I) and quadrature (Q) components of the analog signal comprises:

obtaining a set of N samples comprising in-phase (I) and quadrature (Q) components of the analog signal, wherein each sample pair comprises an in-phase and quadrature component taken at a same time.

3. The method of claim 1, wherein the weighting coefficients are selected from the class of integers known as Mersenne prime numbers.

4. The method of claim 2, wherein the weighting coefficients are consecutive Mersenne prime numbers.

5. The method of claim 1, wherein the steps of combining the N samples with specially selected weighting coefficients and combining the weighted N sample pairs with a phase-rotated Nth sample may be described by

$$y_i = x_i \qquad for \;\; i = 1, \ldots, N$$

LAW OFFICES
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P.
STANFORD RESEARCH PARK
700 HANSEN WAY
PALO ALTO, CALIF. 94304
650-849-6600

$$y_i = x_i^* \left(\frac{x_i}{M_1} + \sum_{k=1}^{N-1} \frac{1}{M_{k+1}} \; y_{i-k} \right) \qquad for \;\; i \geq N$$

wherein x represents the set of N samples, y represents the modified signal, and x_i^* represents the complex conjugate of x_i.

6. The method of claim 5, wherein the weighting coefficients, M_i, are selected from the class of integers known as Mersenne prime numbers.

7. The method of claim 6, wherein the weighting coefficients are consecutive Mersenne prime numbers.

8. The method of claim 1, wherein the weighting coefficients are binomial coefficients.

9. The method of claim 1, wherein the specially-selected weighting coefficients take on alternate signs.

10. An apparatus for improving signal-to-noise ratio of a signal containing noise, the apparatus comprising:

means for receiving an analog signal comprising a desired signal and noise;

means for obtaining a set of N samples representing digital representations of in-phase (I) and quadrature (Q) components of the analog signal;

means for combining the set of N samples with specially-selected weighting coefficients;

means for combining the weighted sample pairs with a phase-rotated Nth sample; and

means for outputting a modified signal, wherein the modified signal is a function of the weighted samples and the phase-rotated Nth sample.

11. The apparatus of claim 10, wherein the means for obtaining in-phase (I) and quadrature (Q) components of the analog signal comprises:

LAW OFFICES
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P.
STANFORD RESEARCH PARK
700 HANSEN WAY
PALO ALTO, CALIF. 94304
650-849-6600

means for obtaining a set of N samples comprising in-phase (I) and quadrature (Q) components of the analog signal, wherein each sample pair comprises an in-phase and quadrature component taken at a same time.

12. The apparatus of claim 10, wherein the weighting coefficients are selected from the class of integers known as Mersenne prime numbers.

13. The apparatus of claim 11, wherein the weighting coefficients are consecutive Mersenne prime numbers.

14. The apparatus of claim 10, wherein the means for combining the N samples with specially-selected weighting coefficients and means for combining the weighted N sample pairs with a phase-rotated Nth sample may be described by

$$y_i = x_i \qquad for \;\; i = 1, \ldots, N$$

$$y_i = x_i^* \left(\frac{x_i}{M_1} + \sum_{k=1}^{N-1} \frac{1}{M_{k+1}} \, y_{i-k} \right) \qquad for \;\; i \geq N$$

wherein x represents the set of N samples, y represents the modified signal, and x_i^* represents the complex conjugate of x_i

15. The apparatus of claim 14, wherein the weighting coefficients, M_i, are selected from the class of integers known as Mersenne prime numbers.

16. The apparatus of claim 15, wherein the weighting coefficients are consecutive Mersenne prime numbers.

17. The apparatus of claim 10, wherein the weighting coefficients are binomial coefficients.

18. The apparatus of claim 10, wherein the specially-selected weighting coefficients take on alternate signs.

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT
& DUNNER, L. L. P.
STANFORD RESEARCH PARK
700 HANSEN WAY
PALO ALTO, CALIF. 94304
650-849-6600

19. A signal processing system comprising:

a sensor capable of receiving an analog signal;

an analog-to-digital converter for obtaining a set of N digital samples comprising in-phase (I) and quadrature (Q) components of the analog signal;

a processor configured to perform the steps of:

combining the set of N digital samples with specially-selected weighting coefficients and a phase-rotated Nth sample, and

outputting a modified signal, wherein the modified signal is a function of Nth weighted samples and the phase-rotated th sample; and

a signal processing device.

20. The apparatus of claim 19, wherein the processor is further configured to combine the set of N digital samples with specially-selected weighting coefficients and a phase-rotated Nth sample according to the following:

$$y_i = x_i \qquad for\ \ i = 1, \ldots, N$$

$$y_i = x_i^* \left(\frac{x_i}{M_1} + \sum_{k=1}^{N-1} \frac{1}{M_{k+1}} y_{i-k} \right) \qquad for\ \ i \geq N$$

wherein x represents the set of N samples, y represents the modified signal, and x_i^* represents the complex conjugate of x_i.

21. The method of claim 20, wherein the weighting coefficients, M_i, are selected from the class of integers known as Mersenne prime numbers.

22. The method of claim 21, wherein the weighting coefficients are consecutive Mersenne prime numbers.

LAW OFFICES
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P.
STANFORD RESEARCH PARK
700 HANSEN WAY
PALO ALTO, CALIF. 94304
650-849-6600

23. The method of claim 19, wherein the weighting coefficients are binomial coefficients.

24. The method of claim 19, wherein the specially-selected weighting coefficients take on alternate signs.

LAW OFFICES
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P.
STANFORD RESEARCH PARK
700 HANSEN WAY
PALO ALTO, CALIF. 94304
650-849-6600